

SOME CHARACTERISTICS OF LEAF AND INFLORESCENCE PRODUCTION OF *STRELITZIA REGINAE* AIT. IN PORT ELIZABETH

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ABSTRACT

Differences in leaf and inflorescence production were found between two cultivated populations of *Strelitzia reginae* in Port Elizabeth. Although these differences could have been due to a number of factors, it is postulated that they were brought about by differences in light regime. The plants of one population were subject to prolonged periods of shading, especially during the winter months. In comparison to plants at a more exposed site, these plants showed decreased leaf and inflorescence production as well as a shorter flowering season. It is possible that low levels of solar energy suppress the development of primordia into inflorescences.

UITTREKSEL

SEKERE KENMERKE VAN BLAAR EN BLOEIWYSE ONTWIKKELING VAN *STRELITZIA REGINAE* AIT. IN PORT ELIZABETH

Verskille in die blaar en bloeiwyse ontwikkeling tussen twee gekweekte bevolkings van *Strelitzia reginae* in Port Elizabeth is gevind. Alhoewel die verskille die gevolg van 'n aantal faktore kan wees, word dit gepostuleer dat dit die gevolg van verskille in die lig regime was. Die plante van een bevolking was, veral gedurende die winter, onderhewig aan lang skaduweeperiodes. In vergelyking met plante in 'n meer blootgestelde terrein het hierdie plante verlaagde blaar en bloeiwyse ontwikkeling getoon, sowel as 'n korter blomtyd. Dit is moontlik dat die lae sonergie vlakke die ontwikkeling van primordia in bloeiwyses onderdruk.

INTRODUCTION

The brilliant colouring and uncommon morphology of the flowers of *Strelitzia reginae* have made them exceptionally popular as cut flowers in the floristry industry. Plants are therefore cultivated in many parts of the world with the sole aim of producing inflorescences for both local and export markets.

Information on flower production of *S. reginae*, as well as on factors controlling flower production, is obviously of vital importance to growers. It is only recently that research on these aspects has been initiated (Halevy, Kofranek & Kubota, 1976). Further research, in the form of an international project, which is being co-ordinated by one of the authors (A.H.H.), has also been conducted. Surveys of leaf and inflorescence production have been made in various countries

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and it is hoped that an analysis of these data will contribute to a greater understanding of floral yield in *S. reginae*.

This article reports on the data collected from cultivated plants in Port Elizabeth. These data are of particular interest as this site is very close to naturally occurring populations of *S. reginae*, this species being indigenous to the Eastern Cape Province in the Republic of South Africa.

MATERIAL AND METHODS

Two surveys were conducted:

Detailed survey of leaf and inflorescence production

Data were collected over a period of two consecutive years from plants growing in a large bed in Settler's Park, Port Elizabeth.

To understand the procedures followed a brief explanation of the mode of leaf production and vegetative multiplication (as described by Dyer, 1972) is necessary. Leaves of *S. reginae* arise distichously from the root stock forming a "fan". This process is finite; after a certain number of leaves have been formed, two leaves emerge back to back as a result of dichotomous branching of the rudimentary stem axis. These two are the first leaves (i.e. the outermost) of two new shoots and subsequent distichous leaf production gives rise to two new fans. The older a plant (or clone) is, the more fans it contains. Inflorescences emerge, from time to time, from the axils of one or more leaves in a fan.

For the purpose of this survey, single fans on 12 different plants were selected on 1977-01-17. Using a latex emulsion paint, the leaves of each fan were numbered, with the oldest (outermost) leaf taken to be number 1. The prefix A was used for each of the leaf numbers of this fan. When leaves emerged back to back, they were labelled B1 and C1 with subsequent leaves of the new fans being labelled B2, B3, etc. and C2, C3, etc., respectively.

The plants were examined at fortnightly intervals during the subsequent two years. Dates on which leaves and inflorescences were visible for the first time were recorded. The length of each inflorescence (total of scape and spathe) was taken each fortnight. After appearance of the first flower, inflorescences were cut off at the base. The data for each plant were set out in graphic form as seen in Figure 1.

After completion of the survey, means and standard errors of the various parameters mentioned in the section on results were calculated. Mean dates of certain events (such as appearance of inflorescences) were calculated by finding the mean figure for the time in weeks (with the date of commencement of the survey taken as zero time) and then converting to the appropriate date.

Comparative survey of flowering at two sites

This survey was conducted over a period of one year commencing on 1978-01-16. Fifteen whole plants or clones (consisting of groups of fans) were

selected at each of two sites. The one site was in Settler's Park and plants were chosen from the same bed as the ones used in the first survey. The other 15 plants were selected from plants growing on a traffic island in the William Moffat Expressway. The two populations were a few kilometres apart and in both cases the plants were growing on the south-facing slopes of the Baakens River Valley.

The total number of leaves on each plant were counted at the commencement and completion of the survey. Inflorescences were counted when the first flowers had appeared, and marked with latex emulsion paint. The populations were visited at fortnightly intervals for this purpose. Means and standard errors for various parameters (see Table 2) were calculated.

RESULTS

Detailed survey of leaf and inflorescence production

The data obtained from each plant were set out as is shown for one particular plant in Figure 1.

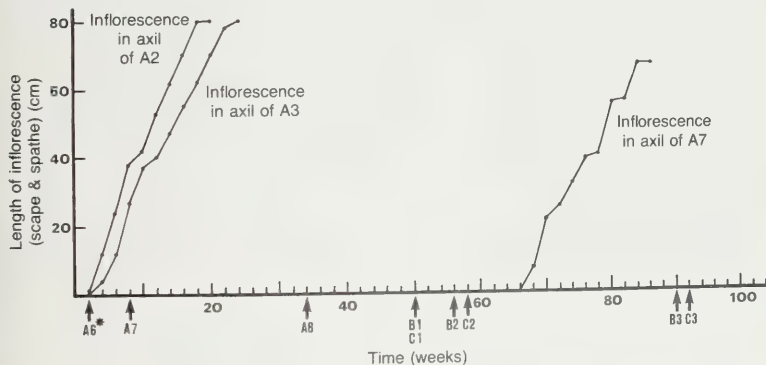


FIG. 1.

Emergence of new leaves and growth of inflorescences on a single fan of *Strelitzia reginae*.

Dates corresponding to the time (in weeks) indicated on the abscissa are as follows:
 0: 1977-01-17; 20: 1977-06-06; 40: 1977-10-24; 60: 1978-03-13; 80: 1978-07-31;
 100: 1978-12-18.

*Emergence of newly differentiated leaves are indicated at the appropriate times below the abscissa. This particular fan had five leaves (A1 to A5) when selected at the commencement of the survey (1977-01-17).

It can be seen in Figure 1 that leaf production in this plant was confined to certain periods while at other times (between weeks 8 and 33, as well as between weeks 58 and 90) no new leaves appeared. This foliar dormant period was characteristic of all specimens in the survey and, on the average, extended over 25,3 ($\pm 1,0$)* weeks in 1977 and 26,2 ($\pm 1,4$) weeks in 1978. As can be seen from the mean dates in Table 1, this interval extended over the winter months.

TABLE 1

Mean dates for manifestation of some vegetative and floral characteristics of *S. reginae* plants in Settler's Park. (The standard error is shown in parenthesis.)

	1977	1978
Mean dates for foliar dormant period	March 31 (± 8 days) to September 22 (± 8 days)	April 18 (± 8 days) to October 18 (± 11 days)
Mean date of inflorescence emergence	January 27 (± 11 days)	January 15 (± 12 days)
Mean date of flower emergence	June 10 (± 16 days)	July 4 (± 20 days)

During the summer months, an average of 4,0 ($\pm 0,1$) new leaves were produced per fan with the mean time between the appearance of successive leaves being 9,0 ($\pm 0,4$) weeks.

Most fans produced only one inflorescence per growing season, with occasionally two differentiating. Where two differentiated this often took place simultaneously (as at week 4 in Fig. 1) or within a few weeks of each other. Mean value was 1,3 ($\pm 0,2$) inflorescences per fan for both 1977 and 1978.

Inflorescences emerged from leaf axils during midsummer (see Table 1). Average time taken from this point to emergence of the first flower out of the spathe was 20,0 ($\pm 1,3$) weeks in 1977 and 24,3 ($\pm 2,0$) weeks in 1978. The result is that although inflorescences appeared in midsummer, the show of blooms was concentrated in midwinter (see Table 1).

Over the two year period of this study, it was found that 3,2 ($\pm 0,3$) axils were infertile (i.e. did not bear inflorescences) between successive, inflorescence-bearing axils. Where two inflorescences were produced per flowering season, they were always from the axils of two successive leaves. Inflorescence production was synchronized in sister fans (i.e. fans produced by the two apical buds after dichotomous branching). This means that inflorescences were produced practically simultaneously from axils of corresponding leaves (say B2 and C2).

Leaves which bore inflorescences in their axils were, on the average, 42,7 ($\pm 1,9$) weeks old.

*Values for standard error are given in parenthesis.

Comparative survey of flowering at two sites

Four of the 15 plants in the Moffat Expressway selected for this survey were growing in the complete shade of young *Celtis africana* trees. This species is deciduous, which means that the four plants were exposed to more or less the same amount of solar energy during the winter months as the open-grown plants.

The selection of plants at this site was done at random and selection of four shaded plants was not intentional. However, summer shade seemed to have such a significant effect on growth that means for the two different groups are presented separately in Table 2.

TABLE 2

Some characteristics of leaf and flower production by *Strelitzia reginae* at two sites in Port Elizabeth. (The standard error is shown in parenthesis.)

	Settler's Park	Moffat Expressway	
		Summer shade	Exposed to full sunlight
Annual percentage increase in number of leaves/plant	14,99(± 2,55)	14,38(± 2,05)	43,79(± 6,96)
Duration of flowering season (weeks)	15,2(± 2,4)	34,5(± 6,2)	39,0(± 3,7)
Flowering period (Mean dates)	1978-05-11 (± 9 days) to 1978-08-27 (± 15 days)	1978-03-13 (± 26 days) to 1978-11-13 (± 30 days)	1978-02-22 (± 11 days) to 1978-11-23 (± 22 days)
Ratio of number of inflorescences to number of leaves	0,145 ± 0,021	0,339 ± 0,015	0,339 ± 0,040

The data in Table 2 show that open-grown plants in the Moffat Expressway exhibited a three-fold greater increase in leaf number during 1978 than plants receiving summer shade or than those growing in Settler's Park.

Exposed plants had a slightly longer flowering season than plants in the shade, but both groups flowered over twice as long a period as plants in Settler's Park. The dates presented in Table 2 for flowering period are mean values for the first and last blooms to appear during the flowering season. The following observations which were made are also of significance.

(a) Not one of the survey plants in Settler's Park flowered before 1978-03-13 or after 1978-11-20 resulting in a distinct bloomless period in summer.

(b) There was not a single period during the year when blooms were not visible in the Moffat Expressway population. Although some of these plants

showed a distinct bloom-free period during the summer, five had open blooms during January and seven during December. Six of the Moffat plants did not exhibit a distinct flowering period but produced blooms on a continuous basis throughout the year. Only one of these was in a shaded position during summer.

An identical number of inflorescences per leaf were produced by exposed and shaded plants in the Moffat Expressway but the value for Settler's Park was less than half of this value.

DISCUSSION

Strelitzia reginae plants growing in Settler's Park exhibited a very distinct growing and flowering season. Leaf production occurred only during the warmer half of the year while inflorescence production was concentrated to an even greater extent to the midsummer period. Actual opening of the blooms occurred mainly during winter as inflorescence growth took place over a period of five to six months.

This is probably not a universal pattern. Plants at the Moffat Expressway site tended to have a less distinct flowering period with blooms appearing throughout the year in this population. The ratio of number of inflorescences produced to number of leaves on these plants was more than double the value obtained from plants in Settler's Park. As mature *S. reginae* plants produce an inflorescence primordium in the axil of every leaf (Efrat-Lir, Halevy and Shoub, 1973) this implies that greater numbers of primordia in the Settler's Park population failed to develop into inflorescences than was the case at the Moffat site. Although this phenomenon could have been done to a number of factors it is postulated to be the result of lower levels of light energy received by the plants in Settler's Park. Although no measurements were made, it was very obvious that groves of tall trees to the north-east and south-west of this population resulted in extensive periods of shading in the mornings as well as in the afternoon, especially during the winter months. Halevy, Kofranek and Kubota (1976) have, in fact, demonstrated that shading can lead to reduced flowering in *S. reginae*. Low light energy is known to promote flower abortion or blasting in various species, possibly due to an effect on assimilate supply and distribution (Halevy, 1975; Sachs, 1977).

Although the few shaded plants at the Moffat site produced far less leaves and showed a shorter flowering period than the exposed plants at this site there was no difference in inflorescence yield between these two groups. Shading was, however, only experienced during the summer months and it could be that winter shading (which was particularly extensive in Settler's Park) is especially critical as regards inflorescence development.

The fact that virtually all the *S. reginae* plants growing in the wild are found on north-facing slopes (Van de Venter & Small, 1975) possibly reflects the

requirements of this species for high levels of solar radiation for growth and reproduction.

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